

IN THE CLAIMS:

Please amend claims 1, 8, 9 and 11 as follows:

1. (Previously Presented) A magnetic recording medium, the magnetic recording medium having a magnetic film on a non-magnetic substrate by intercalating at least an under layer, the proportion of functional groups having N atoms per 100 carbon atoms in a diamond-like carbon protective coating mainly composed of carbon for protecting the magnetic film exceeds 20%,

wherein a lubricating film of perfluoroether having at least one functional group is provided on the protective coating.

2. (Previously Presented) The magnetic recording medium according to claim 1, wherein said diamond-like carbon at least one of the -COOH, -C=O, -COH, and -CNH₂ is included as the functional group.

3. (Withdrawn) A manufacturing method for a magnetic recording medium, in a manufacturing method for a magnetic recording medium having a magnetic film on a non-magnetic substrate by intercalating at least an under layer, characterized in that when a protective film mainly composed of carbon for protecting the magnetic film is formed by an ion beam method or a chemical vapor deposition method, at least one gas among CO₂, NO₂, N₂O is added.

4. (Withdrawn) The manufacturing method for a magnetic recording medium according to claim 3, wherein the protective coating is diamond-like carbon.

5. (Withdrawn) The manufacturing method for a magnetic recording medium according to claim 3, wherein when the protective coating is formed by the ion beam method or the chemical

vapor deposition method, at least one of N₂, Ne, Ar, Kr, Xe and hydrocarbon gas or hydrocarbon gas is used.

6. (Withdrawn) A manufacturing method for a magnetic recording medium, in a manufacturing method for a magnetic recording medium having a magnetic film on a non-magnetic substrate by intercalating at least an under layer, characterized in that when a diamond-like carbon protective coating mainly composed of carbon for protecting the magnetic film is formed by an ion beam method or a chemical vapor deposition method, at least one gas among CO₂, NO₂, N₂O is added.

7. (Withdrawn) A manufacturing method for a magnetic recording medium, in a manufacturing method for a magnetic recording medium having a magnetic film, a protective coating mainly composed of carbon for protecting the magnetic film and a lubricating film of perfluoroether having at least one functional group on a non-magnetic substrate, characterized in that when the protective coating is formed by an ion beam method or a chemical vapor deposition method using at least one of N₂, Ne, Ar, Kr, Xe and hydrocarbon gas or hydrocarbon gas, at least one gas among CO₂, NO₂, and N₂O is added.

8. (Previously Presented) A magnetic storage apparatus, comprising a magnetic recording medium that in the magnetic recording medium having a magnetic film on a non-magnetic substrate by intercalating at least an under layer, a proportion of functional groups having N atoms per 100 carbon atoms in a diamond-like carbon protective coating mainly composed of carbon for protecting the magnetic film exceeds 20%, and a lubricating film of perfluoroether having at least one functional group provided on the protective coating,

a driving part for driving the magnetic recording medium,

a magnetic head having a recording part and a reproducing part,

a recovery reproducing signal processing part for giving and receiving a signal to and from the magnetic head, and a magnetoresistive head as the reproducing part of the magnetic head.

9. (Canceled).

10. (Canceled).

11. (Previously Presented) A magnetic storage apparatus, comprising a magnetic recording medium having a magnetic film on a non-magnetic substrate by intercalating at least an under layer, a proportion of functional groups having N atoms per 100 carbon atoms in a diamond-like carbon protective coating mainly composed of carbon for protecting the magnetic film exceeds 20%, and a lubricating film of perfluoroether having at least one functional group provided on the protective coating.

a driving part for driving the magnetic recording medium, a magnetic head having a recording part and a reproducing part,

a recording reproducing signal processing part magnetic head, and a magnetoresistive head as the reproducing part of the magnetic head.

12. (Previously Presented) The magnetic recording medium according to claim 1, wherein the functional group in said diamond-like carbon is identified by a tag modification method using molecules which have functional groups interacting with the protective coating surface functional groups quantitatively and irreversibly by molecular recognition, and contain fluorine atoms which have high sensitivity coefficient to ESCA.

13. (Currently Amended) A magnetic recording medium, ~~the magnetic recording medium~~ having comprising:

a non-magnetic substrate;

a magnetic film;

an under layer mainly composed of Cr and a seed layer, which are provided between said
~~on a non-magnetic substrate and said magnetic film; by intercalating at least a seed layer and an~~
~~underlayer mainly composed of Cr;~~

a diamond-like carbon protective layer mainly composed of carbon for protecting the
magnetic film; the proportion of functional group having N atoms per 100 carbon atoms in a
~~diamond-like carbon protective mainly composed of carbon for protecting the magnetic film exceeds~~
~~20%; and~~

a lubricating film of perfluoroether having at least one ~~of the~~ functional group, wherein a
proportion of functional groups having N atoms per 100 carbon atoms in said diamond-like carbon
protective layer exceeds 20%.

14. (Previously Presented) A magnetic recording medium, the magnetic recording medium having a magnetic film on a non-magnetic substrate by intercalating at least a seed layer and an under layer mainly composed of Cr, the proportion of functional group composed of at least one of the -COOH, -C=O, -COH, and -NH₂ per 100 carbon atoms in a diamond-like carbon protective mainly composed of carbon for protecting the magnetic film exceeds 20%, and a lubricating film of perfluorether having at least one of the functional group.

15. (Previously Presented) A magnetic recording medium according to claim 13, wherein said proportion of functional group is identified by tag modification method using molecules which have functional groups interacting with the protective coating surface functional groups quantitatively and irreversibly by molecular recognition, and contain fluorine atoms which have high sensitivity coefficient to ESCA.

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16. (Previously Presented) A magnetic recording medium according to claim 14, wherein said proportion of functional group is identified by tag method using molecules which have functional groups interacting with the protective coating surface functional groups quantitatively and irreversibly by molecular recognition, and contain fluorine atoms which have high sensitivity coefficient to ESCA.